IN THE SPECIFICATION:

Please amend the specification as follows:

Delete paragraph [0003] and replace it with the following new paragraph:

[0003] Generally, such apparatus include an illumination system for supplying a ~~projection~~ beam of radiation, a support ~~structure~~ for supporting the patterning device, a substrate holder for holding a substrate, and a projection system for projecting the patterned beam onto a target portion of the substrate. More information with regard to lithographic devices as here described can be gleaned, for example, from U.S. Patent No. 6,046,792, incorporated herein by reference.

Delete paragraph [0005] and replace it with the following new paragraph:

[0005] *mask*: the concept of a mask is well known in lithography, and it includes mask types such as binary, alternating phase-shift, and attenuated phase-shift, as well as various hybrid mask types. Placement of such a mask in the radiation beam causes selective transmission (in the case of a transmissive mask) or reflection (in the case of a reflective mask) of the radiation impinging on the mask, according to the pattern on the mask. In the case of a mask, the support ~~structure~~ will generally be a mask table, which ensures that the mask can be held at a desired position in the incoming radiation beam, and that it can be moved relative to the beam if so desired;

Delete paragraph [0006] and replace it with the following new paragraph:

[0006] *programmable mirror array*: an example of such a device is a matrix-addressable surface having a visco-elastic control layer and a reflective surface. The basic principle behind such an apparatus is that (for example) addressed areas of the reflective surface reflect incident light as diffracted light, whereas unaddressed areas reflect incident light as undiffracted light. Using an appropriate filter, the said undiffracted light can be filtered out of the reflected beam, leaving only the diffracted light behind; in this manner, the beam becomes patterned according to the addressing pattern of the matrix-addressable surface. The required matrix addressing can be performed using suitable ~~electronic means~~ electronics. More information on such mirror arrays can be gleaned, for example, from United States Patent Nos. 5,296,891 and 5,523,193, which are incorporated herein by reference. In the case

of a programmable mirror array, the said support structure may be embodied as a frame or table, for example, which may be fixed or movable as required; and

Delete paragraph [0007] and replace it with the following new paragraph:

[0007] *programmable LCD array*: an example of such a construction is given in United States Patent No. 5,229,872, which is incorporated herein by reference. As above, the support ~~structure~~ in this case may be embodied as a frame or table, for example, which may be fixed or movable as required.

Delete paragraph [0012] and replace it with the following new paragraph:

[0012] For the sake of simplicity, the projection system may hereinafter be referred to as the "lens"; however, this term should be broadly interpreted as encompassing various types of projection system, including refractive optics, reflective optics, and catadioptric systems, for example. The radiation system may also include components operating according to any of these design types for directing, shaping or controlling the ~~projection~~ beam of radiation, and such components may also be referred to below, collectively or singularly, as a "lens." Further, the lithographic apparatus may be of a type having two or more substrate tables (and/or two or more mask tables). In such "multiple stage" devices the additional tables may be used in parallel, or preparatory steps may be carried out on one or more tables while one or more other tables are being used for exposures. Twin stage lithographic apparatus are described, for example, in United States Patent [[No.]] Nos. 5,969,441 and ~~WO 98/40791~~ 6,262,796, incorporated herein by reference.

Delete paragraph [0013] and replace it with the following new paragraph:

[0013] Further, the lithographic apparatus may be of a type having two or more substrate tables (and/or two or more mask tables). In such "multiple stage" devices the additional tables may be used in parallel, or preparatory steps may be carried out on one or more tables while one or more other tables are being used for exposures. Dual stage lithographic apparatus are described, for example, in U.S. Patent [[No.]] Nos. 5,969,441 and ~~WO 98/40791~~ 6,262,796, both incorporated herein by reference.

Delete paragraph [0015] and replace it with the following new paragraph:

SUMMARY OF THE INVENTION

[0015] The principles of the present invention, as embodied and broadly described herein, provide for a lithographic apparatus to provide a lithographic apparatus with an improved focus control system such that substrates of a high quality can be manufactured. In one embodiment, the lithographic apparatus comprises an illumination system configured to provide a beam of radiation, a first support ~~structure~~ configured to support a patterning device that imparts the beam of radiation with a desired pattern in its cross-section, a second support ~~structure~~ that includes a substrate holder for holding a substrate, a projection system configured to project the patterned beam of radiation onto a target portion on a surface of the substrate, and a servo unit configured to position the substrate holder. The apparatus further includes a sensor unit configured to determine a distance of at least one location point on the surface of the substrate relative to a reference plane, a memory unit configured to store surface information of the substrate based on respective distances of corresponding ~~the at least one~~ location [[point]] points on the substrate surface, and a calculating unit configured to determine a feed-forward set-point signal based on the stored surface information, such that the feed-forward set-point signal is forwardly fed to the servo unit in order to position the substrate holder.

Delete paragraph [0021] and replace it with the following new paragraph:

[0021] One embodiment is characterized in that the second support ~~structure~~ comprises a second substrate table, wherein the lithographic apparatus is constructed and arranged to measure with the level sensor surface information of a substrate placed on the second substrate table, while exposing another substrate placed on the said substrate table which is thereby positioned by the servo unit on the basis of surface information of the another substrate. Thus, a dual stage or twin-stage concept is efficiently used for performing the invention.

Delete paragraph [0026] and replace it with the following new paragraph:

[0026] The phrase "patterning device," as used herein, should be broadly interpreted as referring to [[means]] a device that can be used to impart a ~~projection~~ beam of radiation with a pattern in its cross-section such as to create a pattern in a target portion of the substrate. It should be noted that the pattern imparted to the ~~projection~~ beam may not exactly correspond

to the desired pattern in the target portion of the substrate. Generally, the pattern imparted to the ~~projection~~ beam will correspond to a particular functional layer in a device being created in the target portion, such as an integrated circuit.

Delete paragraph [0028] and replace it with the following new paragraph:

[0028] The support ~~structure~~ supports, i.e. bears the weight of, the patterning device. It holds the patterning device in a way depending on the orientation of the patterning device, the design of the lithographic apparatus, and other conditions, such as for example whether or not the patterning device is held in a vacuum environment. The support can be using mechanical clamping, vacuum, or other clamping techniques, for example electrostatic clamping under vacuum conditions. The support ~~structure~~ may be a frame or a table, for example, which may be fixed or movable as required and which may ensure that the patterning device is at a desired position, for example with respect to the projection system. Any use of the terms "reticle" or "mask" herein may be considered synonymous with the more general term "patterning device."

Delete paragraph [0040] and replace it with the following new paragraph:

DETAILED DESCRIPTION

Lithographic Apparatus

[0040] Figure 1 schematically depicts a lithographic apparatus 1 according to a particular embodiment of the invention. The apparatus is of the type having two substrate tables ~~WTa and WTb,~~ and comprises:

Delete paragraph [0041] and replace it with the following new paragraph:

[0041] *an illumination system IL*: an illumination system (illuminator) IL for providing a ~~projection~~ beam PB of radiation (e.g. UV or EUV radiation);

Delete paragraph [0042] and replace it with the following new paragraph:

[0042] *a first support ~~structure~~ (e.g. a mask table or holder) MT*: for supporting patterning device (e.g. a mask) MA and connected to a first servo unit PM for accurately positioning the patterning device with respect to [[item]] projection system PL;

Delete paragraph [0043] and replace it with the following new paragraph:

[0043] *a second support ~~structure~~*: comprising a substrate holder (e.g. a wafer table) WT for holding a substrate (e.g. a resist-coated wafer) W and connected to a second servo unit PW for accurately positioning the substrate with respect to [[item]] projection system PL; and

Delete paragraph [0044] and replace it with the following new paragraph:

[0044] [[*a]] the projection system (e.g. a reflective projection lens) PL[[:]]* for imaging a pattern imparted to the ~~projection~~ beam PB by patterning device MA onto a target portion C (e.g. comprising one or more dies) of the substrate W.

Delete paragraph [0045] and replace it with the following new paragraph:

[0045] As here depicted, the apparatus is of a ~~transmissive~~ reflective type (i.e. has a ~~transmissive~~ reflective mask). However, in general, it may also be of a reflective type, for example (with a ~~reflective~~ transmissive mask). Alternatively, the apparatus may employ another kind of patterning device, such as a programmable mirror array of a type as referred to above.

Delete paragraph [0046] and replace it with the following new paragraph:

[0046] The illuminator IL receives ~~a beam~~ of radiation from a radiation source SO. The source and the lithographic apparatus may be separate entities, for example when the source is a plasma discharge source. In such cases, the source is not considered to form part of the lithographic apparatus and the radiation ~~beam~~ is generally passed from the source SO to the illuminator IL with the aid of a radiation collector comprising for example suitable collecting mirrors and/or a spectral purity filter. In other cases the source may be integral part of the apparatus, for example when the source is a mercury lamp. The source SO and the illuminator IL, may be referred to as a radiation system.

Delete paragraph [0047] and replace it with the following new paragraph:

[0047] The illuminator IL may comprise an adjusting [[means]] device for adjusting the angular intensity distribution of the beam. Generally, at least the outer and/or inner radial extent (commonly referred to as σ-outer and σ-inner, respectively) of the intensity distribution in a pupil plane of the illuminator can be adjusted. The illuminator provides a

conditioned beam of radiation~~, referred to as the projection beam~~ PB, having a desired uniformity and intensity distribution in its cross-section.

Delete paragraph [0048] and replace it with the following new paragraph:

[0048] The ~~projection~~ beam PB is incident on the mask MA, which is held on the mask table MT. Being reflected by the mask MA, the ~~projection~~ beam PB passes through the lens PL, which focuses the beam onto a target portion C of the substrate W. With the aid of the second servo unit PW and position sensor IF2 (e.g. an interferometric device), the substrate table WT can be moved accurately, e.g. so as to position different target portions C in the path of the beam PB. Similarly, the first servo unit PM and position sensor IF1 can be used to accurately position the mask MA with respect to the path of the beam PB, e.g. after mechanical retrieval from a mask library, or during a scan. In general, movement of the object tables MT and WT will be realized with the aid of a long-stroke module (coarse positioning) and a short-stroke module (fine positioning), which form part of the first servo unit PM and the servo unit PW. However, in the case of a stepper (as opposed to a scanner) the mask table MT may be connected to a short stroke actuator only, or may be fixed. Mask MA and substrate W may be aligned using mask alignment marks M1, M2 and substrate alignment marks P1, P2.

Delete paragraph [0050] and replace it with the following new paragraph:

[0050] *step mode*: the mask table MT and the substrate table WT are kept essentially stationary, while an entire pattern imparted to the ~~projection~~ beam is projected onto a target portion C in one go (i.e. a single static exposure). The substrate table WT is then shifted in the X and/or Y direction so that a different target portion C can be exposed. In step mode, the maximum size of the exposure field limits the size of the target portion C imaged in a single static exposure.

Delete paragraph [0051] and replace it with the following new paragraph:

[0051] *scan mode*: the mask table MT and the substrate table WT are scanned synchronously while a pattern imparted to the ~~projection~~ beam is projected onto a target portion C (i.e. a single dynamic exposure). The velocity and direction of the substrate table WT relative to the mask table MT is determined by the (de-)magnification and image reversal characteristics of the projection system PL. In scan mode, the maximum size of the exposure field limits the

width (in the non-scanning direction) of the target portion in a single dynamic exposure, whereas the length of the scanning motion determines the height (in the scanning direction) of the target portion.

Delete paragraph [0052] and replace it with the following new paragraph:

[0052] *other mode*: the mask table MT is kept essentially stationary holding a programmable patterning device, and the substrate table WT is moved or scanned while a pattern imparted to the ~~projection~~ beam is projected onto a target portion C. In this mode, generally a pulsed radiation source is employed and the programmable patterning device is updated as required after each movement of the substrate table WT or in between successive radiation pulses during a scan. This mode of operation can be readily applied to maskless lithography that utilizes programmable patterning device, such as a programmable mirror array of a type as referred to above.

Delete paragraph [0061] and replace it with the following new paragraph:

[0061] In a dual-stage apparatus, first the complete wafer height map (surface information of the substrate) is measured at the measurement stage, as indicated in Figure 4 by 'Level Sensor' LS. The measurements can be stored in a memory unit (this memory unit can be connected via electronics to the level sensor LS). The wafer height is determined, similar to that described in the previously. The used level sensor, however, utilizes a larger array of measurement location [[point]] points and hence creates much finer detailed data than previously. This yields an array of measured distances as a function of two-dimensional co-ordinates in a reference plane.

Delete paragraph [0064] and replace it with the following new paragraph:

[0064] The 'Setpoint generator' SET [[in]] evaluates the polynomials as a function of time and hence creates the stage position setpoints. In addition, it creates the stage acceleration setpoints as a function of time. This step requires a double differentiation of the polynomials, which is an easy symbolic manipulation. In fact, the acceleration is created by evaluating a new 2^{nd} or 3^{rd} order polynomial which is derived from the original 4^{th} or 5^{th} order polynomials. The calculating unit in this embodiment includes the blocks MF, PF, SET. The servo unit is indicated by the block PW.

Delete paragraph [0078] and replace it with the following new paragraph:

[0078] The dual stage system uses a nine location [[point]] points level sensor array. Each location point of the array can measure the wafer surface height over an area of 2.8x2.5 mm2. By using overlapping measurements in the scanning direction spatial resolution is increased to 2.8x0.5 mm2. This means that the level sensor location point points are not filtering the height information to calculate exposure slit size optimized leveling profiles. A complete wafer height map is determined by scanning the complete 300 mm wafer underneath the sensor in a pattern corresponding to the exposure fields. Figure 2.3 gives an example of a measured wafer map of a checkerboard wafer which is a wafer with etched fields of about 300 nm deep.